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/* Parameters */
#define N_INPUT_PARMS_VOLUME 8
#define N_INPUT_PARMS_FLOW 7
#define N_INPUT_PARMS_PARTITION 5
#define N_INPUT_PARMS_ABSORPTION 3
#define N_INPUT_PARMS_PHYS 5
#define N_INPUT_PARMS_NONDOSING (N_INPUT_PARMS_VOLUME + N_INPUT_PARMS_FLOW +
N_INPUT_PARMS_PARTITION + N_INPUT_PARMS_ABSORPTION + N_INPUT_PARMS_PHYS)
#define N_INPUT_PARMS_DOSING 2
#define N_INPUT_PARMS_USEELSEWHERE 17
#define N_INPUT_PARMS (N_INPUT_PARMS_NONDOSING + N_INPUT_PARMS_DOSING +
N_INPUT_PARMS_USEELSEWHERE)
#define N_CALCULATED_PARMS 0
#define N_PARMS (N_INPUT_PARMS + N_CALCULATED_PARMS)

#define N_STATE 9
/* Number of extra values calculated at each time point in addition to derivatives */
#define N_EXTRA 1

typedef struct {
    char *name;
    double *value;
    int ndim;
    int *dim;
} ParmType;

static ParmType _RDy_parms[] = {
// Input arguments:
/* Tissue volume parameters */
    {.name = "Vgut",
     .ndim = 1
    },
    {.name = "Vlung",
     .ndim = 1
    },
    {.name = "Vart",
     .ndim = 1
    },
    {.name = "Vven",
     .ndim = 1
    },
    {.name = "Vderm",
     .ndim = 1
    },
    {.name = "Vrest",
     .ndim = 1
    },
    {.name = "Vliver",
     .ndim = 1
    },
    {.name = "Vkidney",
     .ndim = 1
    },
    /* Flow parameters */
    {.name = "Qcardiac",
     .ndim = 1
    }

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},
{.name = "Qgut",
 .ndim = 1
},
{.name = "Qderm",
 .ndim = 1
},
{.name = "Qrest",
 .ndim = 1
},
{.name = "Qliver",
 .ndim = 1
},
{.name = "Qkidney",
 .ndim = 1
},
{.name = "Qgfr",
 .ndim = 1
},
/* Partition coefficient parameters */
{.name = "Krbc2plasma",
 .ndim = 1
},
{.name = "Kliver2plasma",
 .ndim = 1
},
{.name = "Kderm2plasma",
 .ndim = 1
},
{.name = "Krest2plasma",
 .ndim = 1
},
{.name = "Kkidney2plasma",
 .ndim = 1
},
/* Absorption rate parameters */
{.name = "kgutabs",
 .ndim = 1
},
{.name = "kinhabs",
 .ndim = 1
},
{.name = "kdermabs",
 .ndim = 1
},
/* Other physiologic parameters parameters */
{.name = "Fraction_unbound_plasma",
 .ndim = 1
},
{.name = "hematocrit",
 .ndim = 1
},
{.name = "CLbiliary",
 .ndim = 1
},
{.name = "CLmetabolism",

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.ndim = 1
},
/* toggle to get the derivative as amounts rather than concentrations */
{name = "UseAmounts",
.ndim = 1
},
/* Dosing parameters */
{name = "Cair",
.ndim = 1
},
{name = "Ccontact",
.ndim = 1
},
/* Parameters not directly used to calculate derivative: */
{name = "BW",
.ndim = 1
},
{name = "Vartc",
.ndim = 1
},
{name = "Vvenc",
.ndim = 1
},
{name = "Vgutc",
.ndim = 1
},
{name = "Vliverc",
.ndim = 1
},
{name = "Vkidneyc",
.ndim = 1
},
{name = "Vlungc",
.ndim = 1
},
{name = "Vdermc",
.ndim = 1
},
{name = "Vrestc ",
.ndim = 1
},
{name = "Qcardiacc",
.ndim = 1
},
{name = "Qgutf",
.ndim = 1
},
{name = "Qdermf",
.ndim = 1
},
{name = "Qliverf",
.ndim = 1
},
{name = "Qkidneyf",
.ndim = 1
},
},

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{.name = "Qgfrc",
 .ndim = 1
},
{.name = "ivdose",
 .ndim = 1
},
{.name = "DietInput",
 .ndim = 2
}
/* State variables that only change in JUMPS*/
};

// Input arguments:
#define Vgut_RDy_parms[0].value[0]
#define Vlung_RDy_parms[1].value[0]
#define Vart_RDy_parms[2].value[0]
#define Vven_RDy_parms[3].value[0]
#define Vderm_RDy_parms[4].value[0]
#define Vrest_RDy_parms[5].value[0]
#define Vliver_RDy_parms[6].value[0]
#define Vkidney_RDy_parms[7].value[0]
#define Qcardiac_RDy_parms[0+N_INPUT_PARMS_VOLUME].value[0]
#define Qgut_RDy_parms[1+N_INPUT_PARMS_VOLUME].value[0]
#define Qderm_RDy_parms[2+N_INPUT_PARMS_VOLUME].value[0]
#define Qrest_RDy_parms[3+N_INPUT_PARMS_VOLUME].value[0]
#define Qliver_RDy_parms[4+N_INPUT_PARMS_VOLUME].value[0]
#define Qkidney_RDy_parms[5+N_INPUT_PARMS_VOLUME].value[0]
#define Qgfr_RDy_parms[6+N_INPUT_PARMS_VOLUME].value[0]
#define Krbc2plasma_RDy_parms[0+N_INPUT_PARMS_VOLUME+N_INPUT_PARMS_FLOW].value[0]
#define Kliver2plasma
_RDy_parms[1+N_INPUT_PARMS_VOLUME+N_INPUT_PARMS_FLOW].value[0]
#define Kderm2plasma
_RDy_parms[2+N_INPUT_PARMS_VOLUME+N_INPUT_PARMS_FLOW].value[0]
#define Krest2plasma
_RDy_parms[3+N_INPUT_PARMS_VOLUME+N_INPUT_PARMS_FLOW].value[0]
#define Kkidney2plasma
_RDy_parms[4+N_INPUT_PARMS_VOLUME+N_INPUT_PARMS_FLOW].value[0]
#define kgutabs
_RDy_parms[0+N_INPUT_PARMS_VOLUME+N_INPUT_PARMS_FLOW+N_INPUT_PARMS_PARTITI
ON].value[0]
#define kinhabs
_RDy_parms[1+N_INPUT_PARMS_VOLUME+N_INPUT_PARMS_FLOW+N_INPUT_PARMS_PARTITI
ON].value[0]
#define kdermabs
_RDy_parms[2+N_INPUT_PARMS_VOLUME+N_INPUT_PARMS_FLOW+N_INPUT_PARMS_PARTITI
ON].value[0]
#define Fraction_unbound_plasma
_RDy_parms[0+N_INPUT_PARMS_VOLUME+N_INPUT_PARMS_FLOW+N_INPUT_PARMS_PARTITI
ON+N_INPUT_PARMS_ABSORPTION].value[0]
#define hematocrit
_RDy_parms[1+N_INPUT_PARMS_VOLUME+N_INPUT_PARMS_FLOW+N_INPUT_PARMS_PARTITI
ON+N_INPUT_PARMS_ABSORPTION].value[0]
#define CLbiliary
_RDy_parms[2+N_INPUT_PARMS_VOLUME+N_INPUT_PARMS_FLOW+N_INPUT_PARMS_PARTITI
ON+N_INPUT_PARMS_ABSORPTION].value[0]
#define CLmetabolism

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_RDy_parms[3+N_INPUT_PARMS_VOLUME+N_INPUT_PARMS_FLOW+N_INPUT_PARMS_PARTITI
ON+N_INPUT_PARMS_ABSORPTION].value[0]
#define UseAmounts
_RDy_parms[4+N_INPUT_PARMS_VOLUME+N_INPUT_PARMS_FLOW+N_INPUT_PARMS_PARTITI
ON+N_INPUT_PARMS_ABSORPTION].value[0]

// Dosing input parameters:
#define Cair _RDy_parms[N_INPUT_PARMS_NONDOSING + 0].value[0]
#define Ccontact _RDy_parms[N_INPUT_PARMS_NONDOSING + 1].value[0]

/* Computed Parameters */

/* State Variable Definitions */
#define Agutlumen _RDy_vliver_pbpk_state[0]
#define Cgut _RDy_vliver_pbpk_state[1]
#define Clung _RDy_vliver_pbpk_state[2]
#define Cart _RDy_vliver_pbpk_state[3]
#define Cderm _RDy_vliver_pbpk_state[4]
#define Cven _RDy_vliver_pbpk_state[5]
#define Crest _RDy_vliver_pbpk_state[6]
#define Cliver _RDy_vliver_pbpk_state[7]
#define Ckidney _RDy_vliver_pbpk_state[8]

/* Derivative Definitions */
#define Agutlumen_dot _RDy_vliver_pbpk_ydot[0]
#define Cgut_dot _RDy_vliver_pbpk_ydot[1]
#define Clung_dot _RDy_vliver_pbpk_ydot[2]
#define Cart_dot _RDy_vliver_pbpk_ydot[3]
#define Cderm_dot _RDy_vliver_pbpk_ydot[4]
#define Cven_dot _RDy_vliver_pbpk_ydot[5]
#define Crest_dot _RDy_vliver_pbpk_ydot[6]
#define Cliver_dot _RDy_vliver_pbpk_ydot[7]
#define Ckidney_dot _RDy_vliver_pbpk_ydot[8]

/* Extra variables, defined algebraically */
#define Ratioblood2plasma _RDy_vliver_pbpk_extras[0]

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